OAK RIDGE NATIONAL LABORATORY
Managed by UT-Battelle for the Department of Energy

National Hydropower Asset Assessment (NHAAP)

Boualem Hadjerioua, Ph D

Water Resources Engineer Eco-hydraulics
Wind and Water Power Technologies
Environmental Science Division (ESD)

Earth Science Information Partners (ESIP)
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Challenges in Building a New National Water Power GIS

Data Sources

- US Energy Information Administration (EIA)
- National Inventory of Dams (NID)
- US Geological Survey (USGS)
- National Hydrography Dataset (NHD)
- US Historical Climatology Network (USHCN)
- Federal Energy Regulatory Commission (FERC)
- US Bureau of Reclamation (USBR)
- Army Corps of Engineers (USCOE)
- Tennessee Valley Authority (TVA)

Understanding the data user needs

- Primarily get an assessment of the national water power assets
- Build a comprehensive report on the existing hydropower asset
- Evaluate potential hydropower development

What data is being provided

- Comprehensive summary of Water power assets in the United States
- Map images with various representations of these assets
- Graphs showing trends in generation, water flow, climate and other relevant time series data
- Reports analyzing the water power assets and their generation potential
- Forecast of future generation potential
- Active Data archive maintaining and distributing the asset data base for future resource analysis

Challenges in assembling the data

- Information duplication
- Matching the records from various data sources no common format/standard
- Inconsistency across agencies

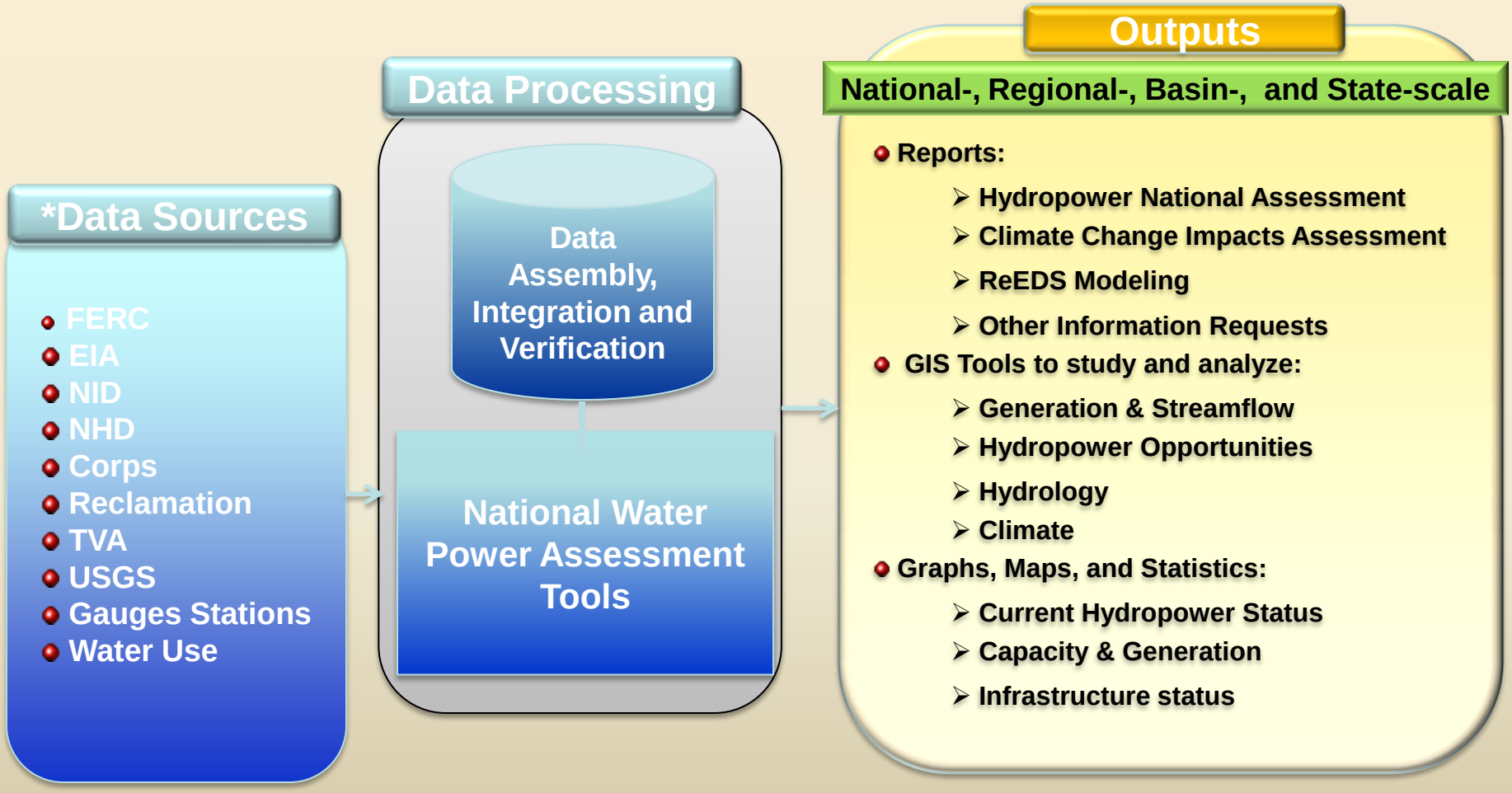
Geo-location Errors

- Dams location
- Wrong attribute information
- Wrong drainage area information
- Incomplete records
- Outdated information

Data delivery

- Standardizing the data for use by various agencies
- Detailed documentation, workflow charts highlighting the data assembly procedures
- description of each attributes
- Several auxiliary data such as road networks, land cover, protected areas database etc
- Assemble the data into non-proprietary file format for use across agencies

Water Power Assessment and Visualization tools are at the Center of Current Hydropower Assessment



*Most of the data are covered by a non-disclosure agreements

National Hydropower Asset Assessment has evolved to include different activities

Initial scope from 2009

Assess condition and performance of all existing federal and nonfederal facilities

- Project characteristics
  - *Power plants and equipment*
  - *Dams, diversions and reservoirs (energy storage)*
  - *Connectivity in river basins*
- Generation patterns for at least 10 years
- Water availability and competing water uses

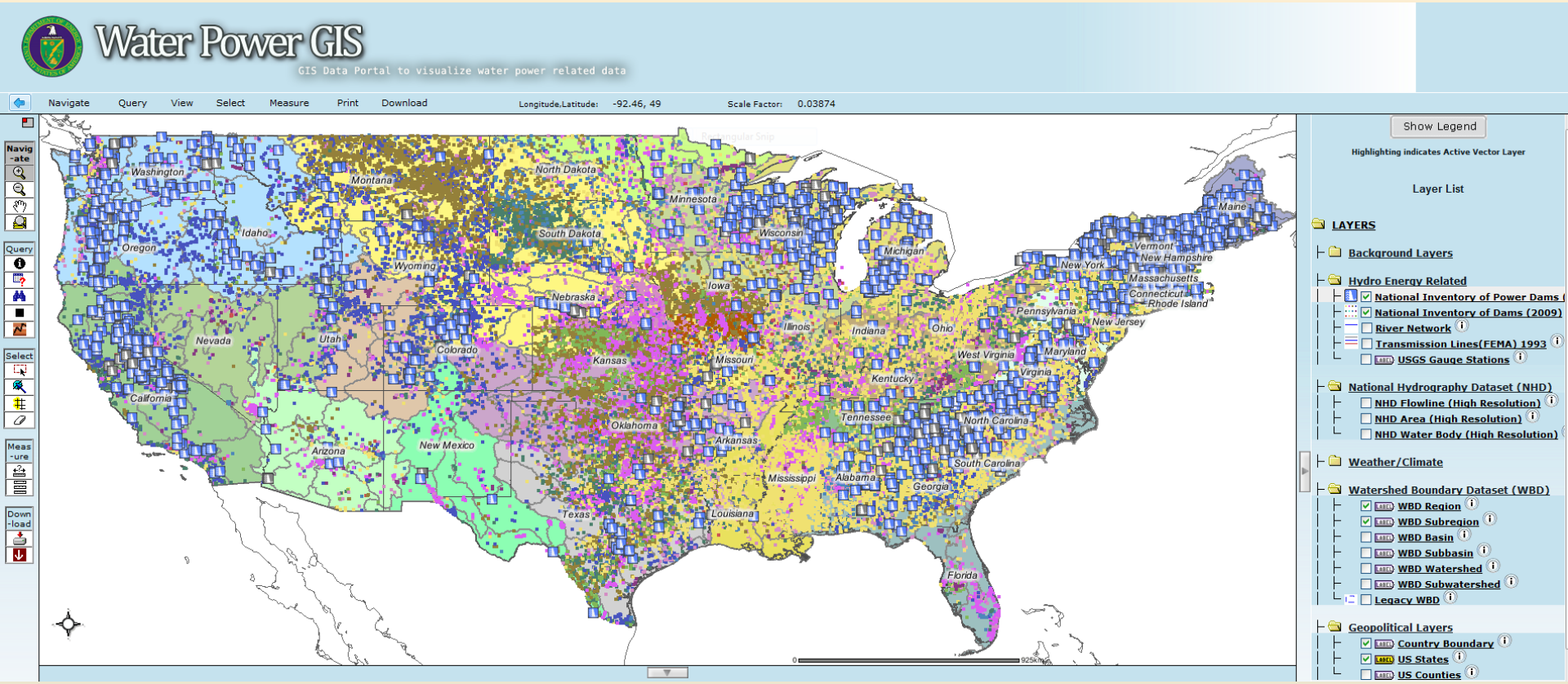
Expanded scope in 2010 - 2011

- Add pumped storage projects
- Add cost of development data
- Import data from new resource assessments
- Assessment of climate change impacts
- Collaboration with: NOAA and PMA
- Building new relations with USGS

Analysis Team

ORNL, subcontractors, other Labs and private sector advisors, and cooperation from Federal agencies (Corps, Bureau, TVA)

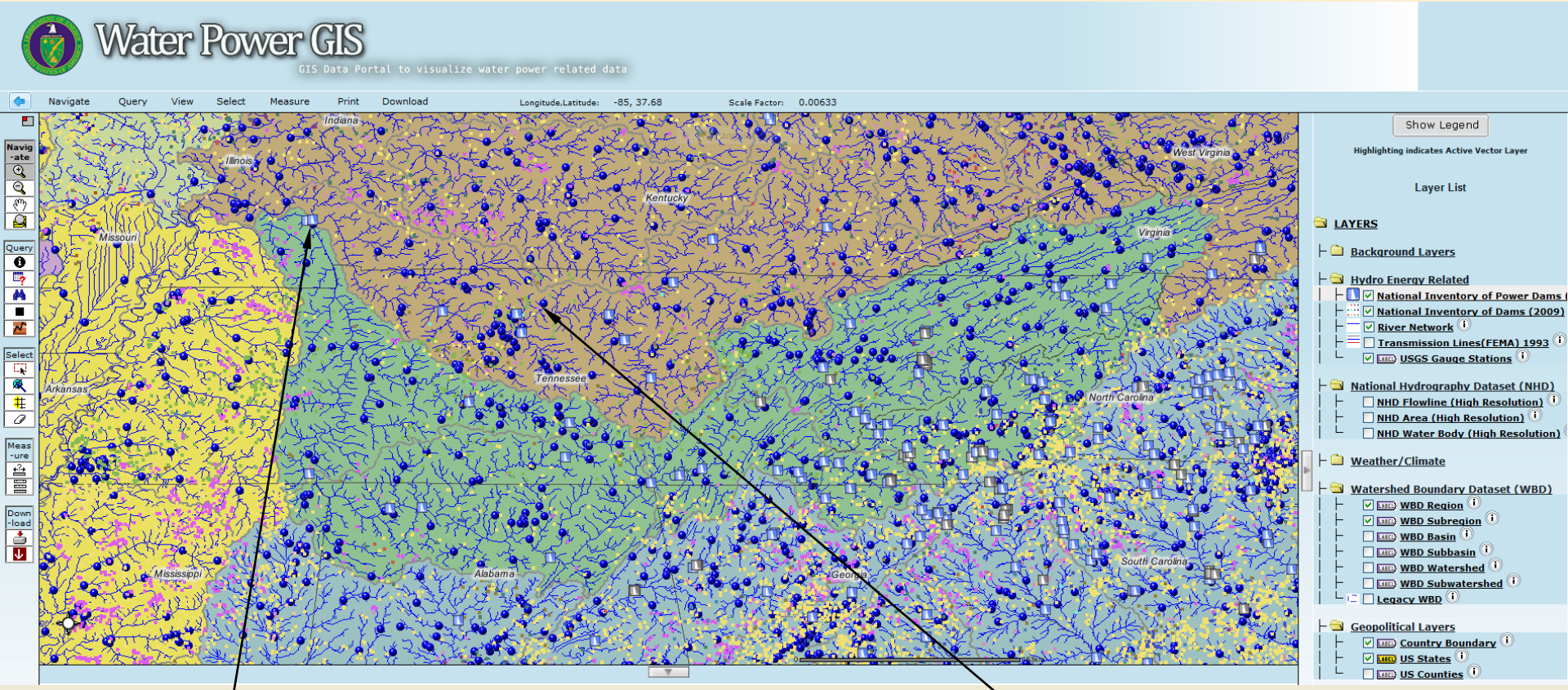
National Hydropower Asset Assessment

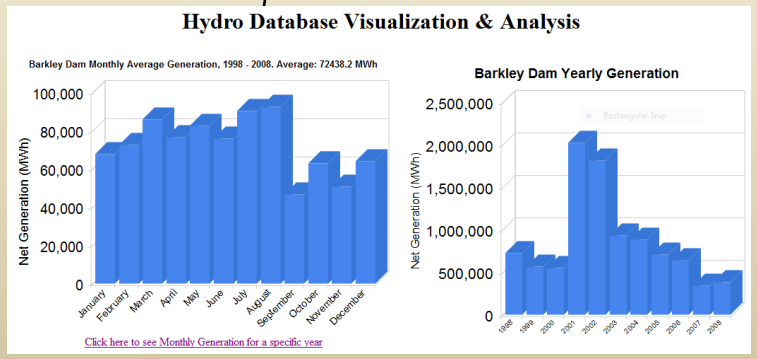


Summary:

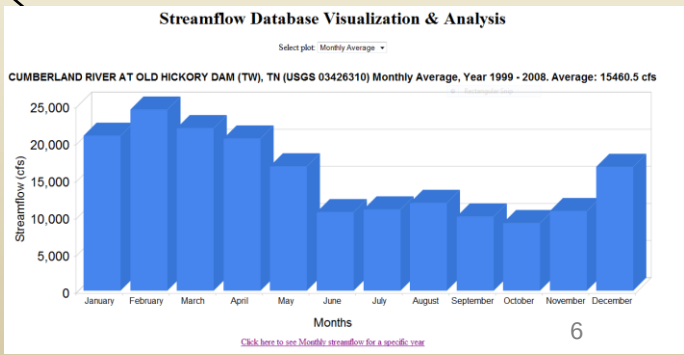
- ~ 84,000 Dams
- ~ 17,000 USGS
- ~ 5,200 Generators
- ~ 1,200 Climatology Stations,
- National Hydrographic Dataset
- State, Region, Sub-region, Basin, Sub-basin, Watershed and Sub-watershed Boundaries

Hydrology and Generation statistics can be displayed by location within any river basin

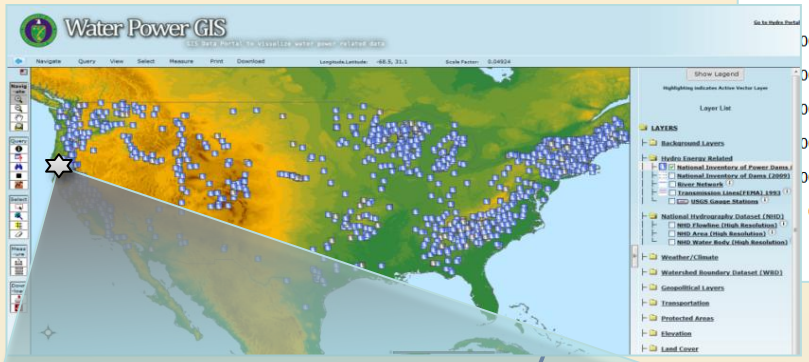


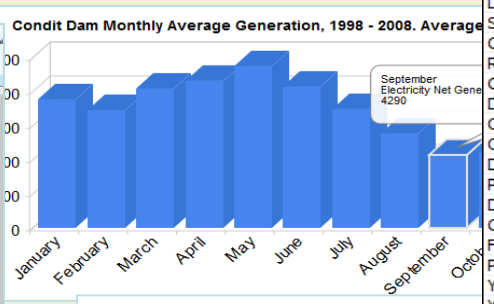


- River Network
- USGS Gauges Stations
- Hydropower Dam
- Non Power Dam
- Airports
- Many Other Layers



NHAAP Water Power GIS Output Samples





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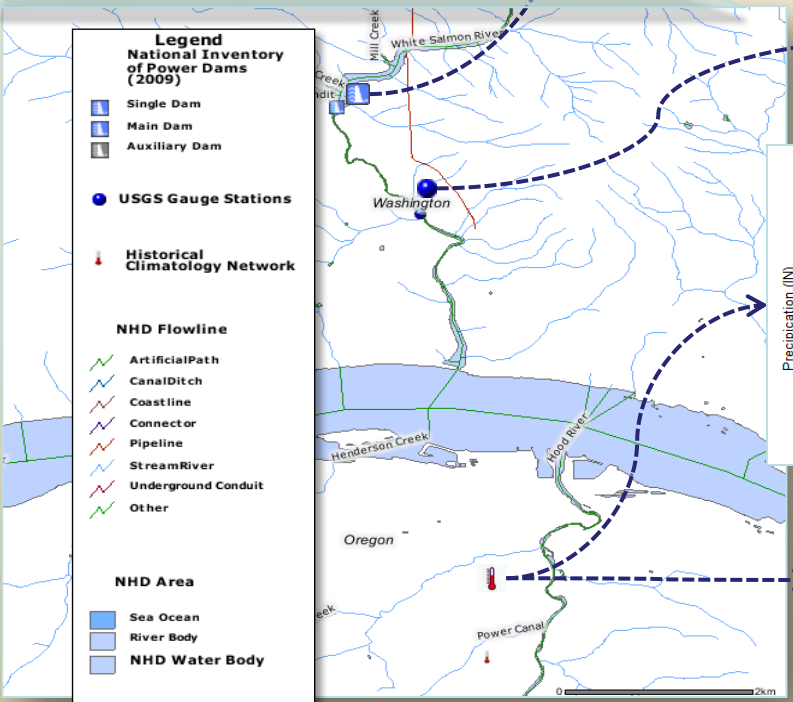
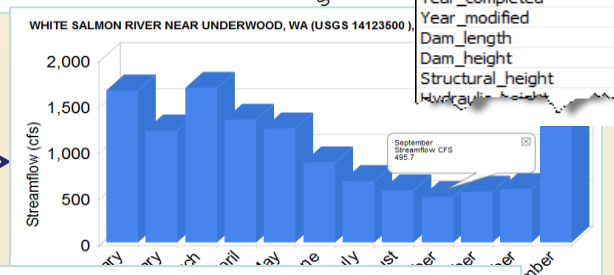
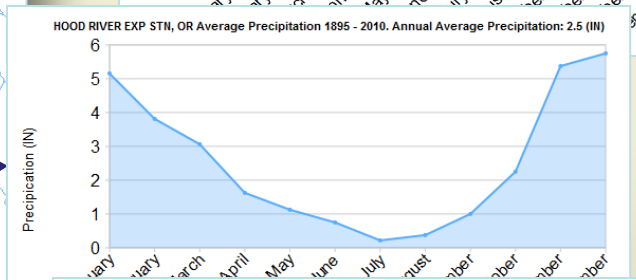
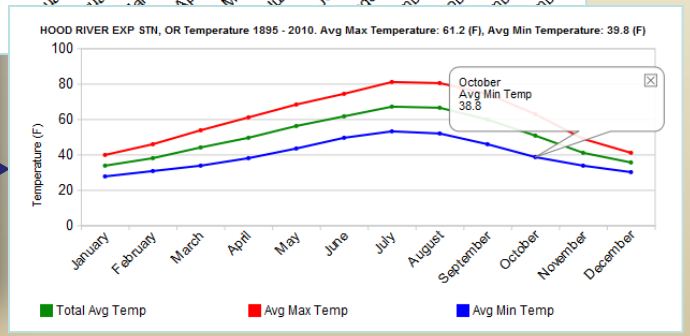
Other_dam_name	
Dam_former_name	<null>
STATEID	02342-01-01
NIDID	WA00001
Longitude	-121.5383
Latitude	45.7683
Section_	T3N,R10E,S10,WM
County	Skamania
River	White Salmon River
City	Underwood, WA
Distance	3
Owner_name	PacifiCorp
Owner_type	P
Dam_designer	STONE & WEBSTER
Private_dam	N
Dam_type	CNPG
Core	HCK
Foundation	RK
Purposes	HRF
Year_completed	1913
Year_modified	<null>
Dam_length	471
Dam_height	125
Structural_height	0





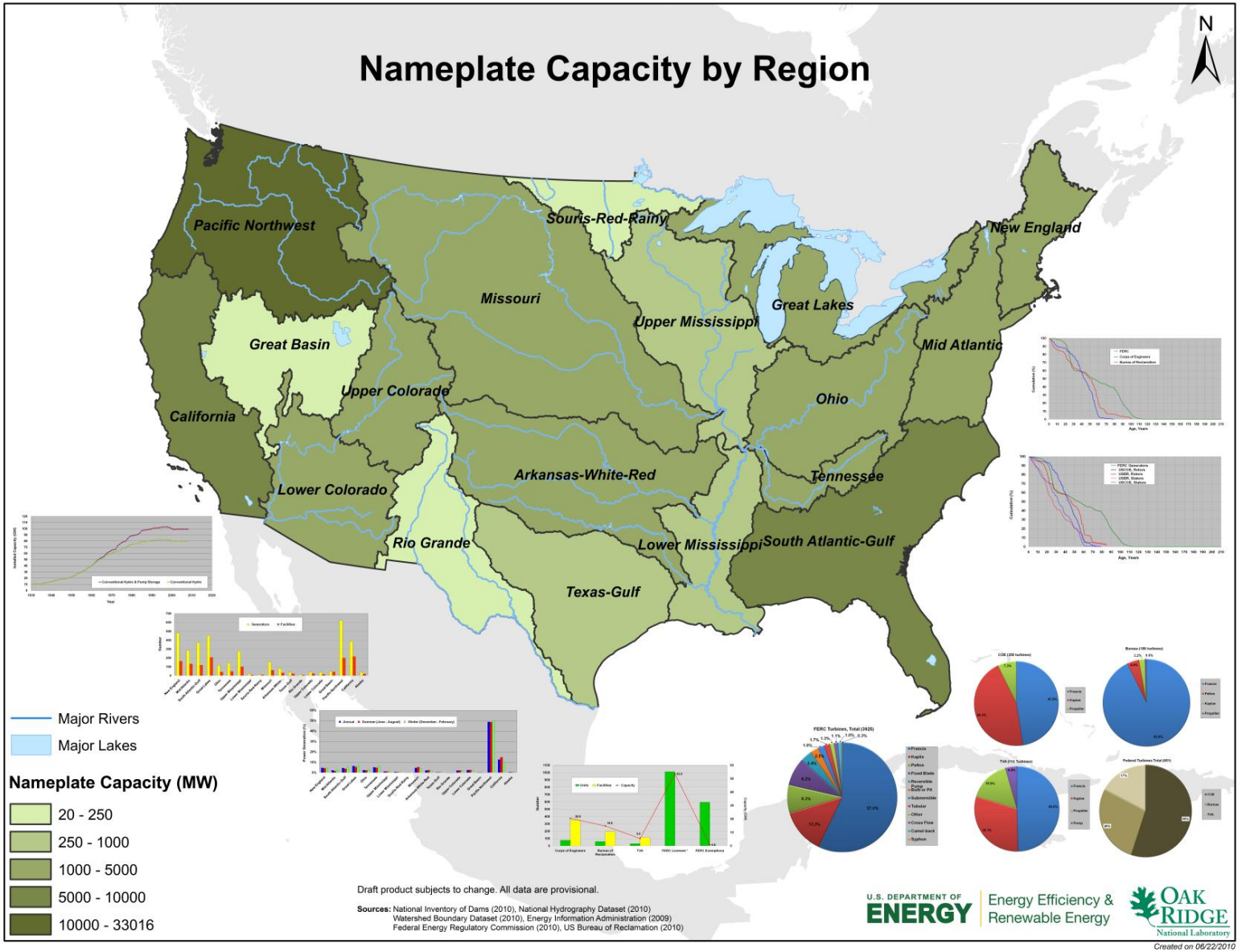




- Hydropower
- Streamflow
- Temperature
- Precipitation
- Elevation
- Transmission
- Water use
- Land
- Etc.

One of Several Poster National Maps Created by ORNL

Hydrologic Region coded by Hydropower Capacity



Questions can now be Answered by the new NHAAP

Question: How many dams would be candidates for the Alden Fish-Friendly Turbine?

- Suitable dams and rivers: 50-150 ft tall, 500-2000 cfs flow
- Presence of migratory fish populations
- Priorities: Current Francis turbines older than 25 years

Question: What projects and regions are accounting for the year-to-year variability in hydropower generation, and what are the characteristics of those projects?

- Generation and streamflow variability computed from historic records
- Possible monetary gain/loss corresponding to different variability

Question: Where should we start to upgrade/add generators?

- Find the most aging and inefficient units
- Higher priority for regions with sufficient domestic water use and growing power demand

Question: Can we utilize the off-peak power generation better?

- Find the best location for adding pump-storage facilities
- System optimization supported by the integrated NHAAP inventory

Question: Can we evaluate climate change impact on federal hydropower generation?

- Use the national hydrological impact study
- Historical hydrology: precipitation-streamflow-generation relationship

Questions?